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Which Accounts for Real Exchange Rate Fluctuations, Deviations from the Law of One Price or Relative Price of Nontraded Goods?

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Abstract

The literature on real exchange rate fluctuations is precisely divided by the views regarding their source. One emphasizes the relative price of nontraded goods to traded goods by assuming nominal rigidities in the nontraded sector or in the factor prices. The other stresses the importance of the traded component or the deviations from the law of one price. In this paper, we use Betts and Kehoe (2001)'s real exchange rate decomposition to explore which component accounts for the bilateral real exchange rate fluctuations among six East Asian countries and the United States. We find that a significant fraction of the variance of real exchange rates is accounted for by the deviations from the law of one price for traded goods, while the relative price of nontraded to traded goods also plays an important role as nominal exchange rate becomes stable.

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1. Introduction

The traditional view on real exchange rate determination is that the main source of real exchange rate fluctuations is the changes in the relative price of nontraded to traded goods across countries. There is a substantial amount of modern research that assumes that the real exchange rate is exactly the relative price of nontraded to traded goods across countries, and there is no role for movements in the international relative prices of traded goods. Rebelo and Vegh (1995), Stockman and Tesar (1995) and Fernandez de Cordoba and Kehoe (2000) present models in which sector specific productivity shocks, real demand shocks and changes in the trade regime cause fluctuations in the relative price of nontraded goods across countries that drive fluctuations in the real exchange rate. The fundamental premise of this theory is that deviations from the law of one price among traded goods are small and temporary because of arbitrage activities in the international goods markets.

However, the relevance of the traditional theory has been recently challenged by some empirical work on the deviations from the law of one price. Evidence assembled by Engel (1993), Engel and Rogers (1996), and Knetter (1997) show that there are large deviations from the law of one price for many traded goods in disaggregated price data. Engel (1999) also shows that the variance of changes in the international relative price of traded goods accounts for 90 percent and higher of the overall variance of real exchange rate changes in variance decompositions of selected bilateral exchange rates between the United States and some other OECD countries. The variance decompositions imply that not only are there large deviations from the law of one price for traded goods, but that these deviations are almost as large as the corresponding deviations from the purchasing power parity (PPP). This evidence has generated an explosion in models of real exchange rates in which deviations from the law of one price among traded goods are the key source of real exchange rate movements (Betts and Devereux, 2000; Chari, Kehoe and McGrattan, 2001).

In response to this challenge, Mendoza (2000) reports that up to 70 percent of the variability of the US dollar–Mexican peso real exchange rate is accounted for by the variability of price of non-traded goods relative to traded goods when Mexico had a managed exchange rate regime. In fact, the studies by Mussa (1986) and Baxter and Stockman (1989) have confirmed that the real exchange rate volatility is very different under different exchange rate regimes.

Betts and Kehoe (2004) study the relation between the United States' bilateral real exchange rate and the associated bilateral relative price of nontraded goods for five of its most important trade partners and find that the relation is stronger the more important is the trade relationship between the United States and a trade partner.

In this paper, we focus on the nominal exchange rate variability and its relationship with the source of exchange rate fluctuations. We explore which component accounts for the bilateral real exchange rate fluctuations among six East Asian countries and the United States, the deviations from the law of one price among traded goods or the relative prices of nontraded to traded goods. In doing so, we examine the relative importance between the two components depends on the nominal exchange rate stability.

The remainder of the paper is organized as follows. Section 2 discusses the theoretical background of Betts and Kehoe (2001)'s variance decompositions. Section 3 presents the estimation results and Section 4 concludes.

2. Variance decomposition of real exchange rates

Following Engel (2000) and Betts and Kehoe (2001), we decompose the real exchange variability into the deviations from the law of one price and the relative price of nontraded goods.

The bilateral real exchange rate between country X and country Y is given by

$$RER_t = NER_t \times \frac{P_t^X}{P_t^Y} \tag{1}$$

where NER_t denotes the nominal exchange rate in terms of country Y currency units per country X currency at date t. P_t^X is a price deflator or index for the basket of goods consumed or produced in country X, and P_t^Y is a price deflator or index for the comparable basket of goods in country Y. Aggregate price levels are thought of a function of the prices of both traded and nontraded goods. We denote by $P_t^{X,T}$ and $P_t^{Y,T}$ price deflators or indices for traded goods in country X and Y, respectively. Multiplying and dividing by the ratio of traded goods prices yields

$$RER_t = (NER_t \frac{P_t^{X,T}}{P_t^{Y,T}})(\frac{P_t^X}{P_t^Y} / \frac{P_t^{X,T}}{P_t^{Y,T}}) \tag{2}$$

In this expression, the first factor denotes the bilateral real exchange rate of traded goods, which we denote by RER_t^T. It measures deviations from the law of one price for traded goods. Notice that it also captures the effect for the real exchange rate of traded goods of any differences in the compositions of the baskets of traded goods across the two countries. The second factor is a ratio of internal relative prices, which we denote as RER_t^N. We can write

$$RER_t^N = (\frac{P_t^{X,T}}{P_t^X(P_t^{X,T}, P_t^{X,N})}) / (\frac{P_t^{Y,T}}{P_t^Y(P_t^{Y,T}, P_t^{Y,N})}) \tag{3}$$

Here RER_t^N is the ratio of a function of the relative price of nontraded goods to traded goods in country X to that in country Y. It is this expression that we refer to as the bilateral relative price of nontraded to traded goods.

The functional form of RER_t^N depends on how the aggregate price of indices are constructed by statisticians in each country. In the case where $P_t^X(P_t^{X,T}, P_t^{X,N}) = (P_t^{X,T})^{1-\alpha}(P_t^{X,N})^{\alpha}$ and $P_t^Y(P_t^{Y,T}, P_t^{Y,N}) = (P_t^{Y,T})^{1-\beta}(P_t^{Y,N})^{\beta}$ (α and β are geometric weights of nontraded goods for country X and Y respectively), for example,

$$RER_t^N = \left(\frac{P_t^{X,N}}{P_t^{X,T}}\right)^{\alpha} / \left(\frac{P_t^{Y,N}}{P_t^{Y,T}}\right)^{\beta}. \qquad (4)$$

In what follows, we use equation (3), rather than equation (4), to calculate RER_t^N and we do not need to measure directly the relative price of nontraded goods to capture the its impact on the real exchange rate determination. All we need are data on traded goods price deflators or price indices, and aggregate price deflators or price indices to decompose the real exchange rate.

We now rewrite (2) as

$$RER_t = NER_t^T \times NER_t^N \qquad (5)$$

which, in logarithms, is

$$rer_t = rer_t^T + rer_t^N. \qquad (6)$$

Hence, the real exchange rate is decomposed into the two parts, one due to the deviations from the law of one price and effects due to differences in the compositions of traded goods output, and the other due to cross-country fluctuations in the relative price of nontraded to traded goods.

We use the consumer price index (CPI) as the measure of overall goods prices and the Whole Sale Price Index (WPI) or Producer Price Index (PPI) as the measure of traded goods prices. In logarithms,

$$rer_t^T = ner_t + \ln(WPI_t^X) - \ln(WPI_t^Y) \tag{7}$$

$$rer_t^N = \ln(CPI_t^X) - \ln(WPI_t^X) - [\ln(CPI_t^Y) - \ln(WPI_t^Y)] \tag{8}$$

This decomposition has the advantage that it covers more countries than any other decomposition. However, there are several problems that seriously damage their worth, as pointed out by Engel (2000).

First, using the aggregate WPI (PPI) as a measure of traded goods prices is crude. Actually the WPI contains a large portion of nontraded intermediate input. Second, the measures of traded goods prices and nontraded goods prices are constructed with different methodologies. The WPI and CPI measures, for example, may have different methods of averaging recordings of disparate prices for the same good; they may survey different location; they may adjust for changes in quality differently. Third, the decomposition allows us to construct an accurate measure of nontraded component only if the aggregate price index is geometric average of traded goods prices and nontraded goods prices. However, the CPI is not constructed this way. Hence, even if the WPI is a good measure of traded goods prices, the decomposition would not give us a good measure of nontraded goods prices. Fourth, the traded and nontraded components are probably negatively correlated by construction since the difference between the logged domestic WPI and the logged foreign WPI appears with a positive sign in the traded component and a negative sign in the nontraded component in the decomposition.

Despite these drawbacks, the decomposition allows us to approximate both traded and nontraded components of real exchange rates in a large sample, since the disaggregated data are not available for most of the emerging markets in the sample. We apply the methodology of decomposition to the real exchange rate series.

3. Empirical results

We first investigate the stationarity of the real exchange rates, the real exchange rates of traded goods and the relative price of nontraded goods for six East Asian economies (Korea, Singapore, Thailand, Indonesia, Malaysia, Japan) and the United States. The price and nominal exchange rate data are monthly and cover the period from January 1975 to December 2003. These periods correspond to the time in which the yen/dollar nominal exchange rate was floating.

We apply unit root tests to these series of the economies. For each series, we perform two unit root test: the Augmented Dickey-Fuller test (Dickey and Fuller, 1979), the Phillips-Perron test (Phillips and Perron, 1988). In each test, test statistics are computed without a time trend.[1] In addition, we select the number of lags by the AIC + 2 criterion in each test.[2]

Table 1 reports the results of unit root test. One cannot generally reject the null hypothesis that the real exchange rates have a unit root for the East Asian currencies in terms of the U.S. dollar and Japanese yen, while the real exchange rates of some country pairs among the East Asian countries are stationary, such as Korea-Thailand,

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[1] Although test statistics are also computed with a time trend, the results are similar to those without a time trend.

[2] Suppose that j is the number of lags which minimizes AIC (Akaike Information Criterion). Then, the AIC + 2 criterion selects the number of lags which is equal to j + 2. See Pantula et al. (1994) for detail.

Philippines-Thailand, Korea-Singapore, and Korea-Philippines. For the real exchange rates of traded goods, the results are similar. Many country pairs among East Asian countries have stationary real exchange rates of traded goods. On the other hand, the relative prices of nontraded to traded goods are generally nonstationary except for Japan-U.S. and Korea-Singapore.

The results may suggest that nominal exchange stability is conducive to stable real exchange rates and prevents the deviations from the law of one price for traded goods because the nominal exchange rates among East Asian countries were relatively stable when their exchange rate regime was a de facto U.S. dollar peg. If this conjecture is true, however, it is puzzling that the unit root tests of real exchange rates and real exchange rates of traded goods are not rejected between any of East Asian countries and the United States.

We then examine two measures of relative volatility of nontraded goods prices to investigate what accounts for the real exchange rate fluctuations: $\sigma(RER\_N)/\sigma(RER)$ and $\sigma(RER\_N)/\sigma(RER\_T)$. The first measure is the volatility of relative price of nontraded goods relative to overall volatility of real exchange rate, while the second is the relative nontraded goods prices volatility relative to the traded goods prices volatility. In calculating these relative volatility measures, we use the percentage changes in each series since most of the series are nonstationary.

We examine the unconditional volatility measures because they capture the long-term volatility of nontraded goods prices. However, in order to capture the short- to medium-term volatility of nontraded goods prices, we also estimate sixth-order autoregressions for the percentage changes in each series and then use the standard deviation of its forecasting error as a volatility measure.

Table 2-1 and 2-2 show the results of unconditional and conditional volatility ratios for 21 country pairs. The results are similar between Table 2-1 and 2-2. It is worth noting that all ratios are below one, which implies that the variance of nontraded component is lower than that of real exchange rate and that of traded component. Furthermore, the volatility ratios of nontraded goods prices are higher some country pairs with Singapore.

Table 2-1 and 2-2 also display the measures of nominal exchange rate volatility. The first measure is the standard deviation of changes in monthly nominal exchange rates, while the second measure is the probability that the percentage changes in the monthly nominal exchange rates fall outside the 2.5 percent band (Calvo and Reinhart, 2002). We expect that the lower the probability is, the more the countries stabilize their nominal exchange rates. To address the exchange rate regime, the latter measure of nominal exchange rate variability is preferable because the standard deviation of nominal exchange rate may be high under a fixed exchange rate regime when East Asian counties experienced currency turmoil in the late 1990s.

The summary statistics of two measures of relative volatility and two measures of nominal exchange rates are shown in Table 3.

Table 4 reports the results of correlation coefficients between the relative volatility and variability of nominal exchange rates. Clearly, the relative volatility of nontraded goods prices is negatively correlated with nominal exchange rate volatility if we use the probability as a measure of nominal exchange rate variability. This suggests that nontraded component plays an increasingly important role to account for real exchange rate variability if nominal exchange rate becomes stable.

The simple standard deviation of nominal exchange rates is not significantly correlated with the relative volatility measures probably because it is not an accurate measure of nominal exchange rate variability.

Figure 1 illustrates 21 samples of our data to show the negative relationship.

4. Conclusion

This paper tries to reconcile the views on real exchange rate determinations. We use Betts and Kehoe (2001)'s real exchange rate decomposition to explore which component accounts for the bilateral real exchange rate fluctuations among six East Asian countries and the United States, the deviations from the law of one price for traded goods or the relative prices of nontraded to traded goods. We find that a significant fraction of the variance of real exchange rates is accounted for by the deviations from the law of one price for traded goods, while the relative price of nontraded to traded goods also plays an important role as nominal exchange rate becomes stable.

These findings have some implications. First, the behavior of the determinants of the real exchange rate differs between exchange rate regimes. Second, even though the variance of relative prices of domestic nontraded goods accounts for a half of the real exchange rate, there is still a non-trivial fraction accounted for by changes in traded goods prices and nominal exchange rates. These findings partly support the suggestion in Engel (2000) that a full explanation of the behavior of the real exchange rate in the literature is likely to require modification to the dominant approach that considers only the role of changes in the relative price of nontraded to traded goods. However, the results indicating that roughly a half of the variability of real exchange rates is attributed to movements in nontraded goods prices are in line with the traditional theory on real exchange rate determinations (Mendoza, 2000). Hence, the modeling of real exchange rates requires emphasizing the relative importance between the deviations from the law of one price and the relative price of nontraded goods, depending on nominal exchange rate stability.

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References

Baxter, M., Stockman, A., 1989. Business Cycles and the Exchange Rate Regime: Some International Evidence. *Journal of Monetary Economics* 23, 377-400.

Betts, C. M., Devereux, M. B., 2000. Exchange Rate Dynamics in a Model of Pricing-to-Market. *Journal of International Economics* 50, 215-244.

Betts, C. M., Koehoe, T. J., 2001. Real Exchange Rate Movements and the Relative Price of Nontraded Goods. Federal Reserve Bank of Minneapolis Research Department Staff Report.

--------------------------, 2004. U.S. Real Exchange Rate Fluctuations and Relative Price Fluctuations. Federal Reserve Bank of Minneapolis Research Department Staff Report No. 334.

Burstein, A., Eichenbaum, M., Rebelo, S., 2004. Large Devaluations and the Real Exchange Rate. NBER Working Paper No. 10986.

Chari, V. V., Kehoe, P. J., McGrattan, E. R., 1996. Can Sticky Price Models Generate Volatility and Persistent Real Exchange Rates? Federal Reserve Bank of Minneapolis, Staff Report 277.

Cheung, Y., Lai, K. S., 2000. On the Cross-country Differences in the Persistence of Real Exchange Rates. *Journal of International Economics* 50, 375-397.

Dickey, D., Fuller, W. A., 1979. Distribution of Estimators for Autoregressive Time Series with a Unit Root. *Journal of American Statistical Association* 83, 857-862.

Engel, C., 1993. Real Exchange Rates and Relative Prices – An Empirical Investigation. *Journal of Monetary Economics* 32, 35-50.

----------, 1999. Accounting for U.S. Real Exchange Rate Changes. *Journal of Political Economy* 107 (3), 507-538.

Engel, C., Rogers, J. H., 1993. How Wide is the Border? *American Economic Review* 86, 1112-1125.

Fernandez de Cordoba, G., Kehoe, T. J., 2000. Capital Flows and Real Exchange Rate Fluctuations Following Spain's Entry into the European Community. *Journal of International Economics* 51, 49-78.

Fukuda, S., Kano, T., 1997. International Price Linkage within a Region: The Case of East Asia. *Journal of Japanese and International Economies* 11 (4), 643-666.

Knetter, M., 1997. International Comparisons of Pricing-to-Market Behavior. *American Economic Review* 83, 473-486.

Mussa, M., 1986. Nominal Exchange Rate Regimes and the Behavior of Real Exchange Rates: Evidence and Implications. *Carnegie-Rochester Conferences Series on Public Policy* 25, 117-214.

Mendoza, E. G., 2000. On the Instability of Variance Decompositions of the Real Exchange Rate across Exchange-Rate-Regimes: Evidence from Mexico and the U.S. NBER Working Paper No. 7768.

Pantula, S. G., Gonzarez-Fariaz, G., Fuller, W., 1994. A Comparison of Unit Root Test Criteria. *Journal of Business Economics and Statistics* 12, 449-459.

Phillips, P. C. B., Perron, P., 1988. Testing for a Unit Root in a Time Series Regression. *Biometrica* 75, 335-346.

Rogoff, K., 1996. The Purchasing Power Parity Puzzle. *Journal of Economic Literature* 34.

Rebelo, S., Vegh, C. A., 1995. Real Effects of Exchange Rate-Based Stabilization: An Analysis of Competing Theories. In: Bernanke, B. S., Rotemberg, J. J. (Eds.), *NBER Macroeconomic Annual 1995*. The MIT Press, 125-174.

Stockman, A. C., Tesar, L. L., 1995. Tasts and Technology in a Two-Country Model of the Business Cycle: Explaining International Comovements. *American Economic Review* 85, 168-185.

Table. 1 Unit root tests of real exchange rates

	Country-pairs			RER			RER_T			RER_N		
				Test Stat.	P Value		Test Stat.	P Value		Test Stat.	P Value	
1	Japan	US	ADF	-1.881	0.341		-1.847	0.357		-3.349	0.013	**
			PP	-7.084	0.264		-7.496	0.276		-14.294	0.015	**
2	Indonesia	US	ADF	-1.437	0.564		-1.981	0.295		-1.471	0.548	
			PP	-3.322	0.596		-5.983	0.417		-2.648	0.550	
3	Korea	US	ADF	-1.888	0.338		-1.540	0.514		-1.295	0.631	
			PP	-7.914	0.298		-5.034	0.576		-4.068	0.590	
4	Philipines	US	ADF	-1.179	0.683		-1.974	0.298		-1.571	0.498	
			PP	-3.512	0.712		-9.642	0.277		-2.594	0.504	
5	Singapore	US	ADF	-2.257	0.186		-1.461	0.553		-1.399	0.583	
			PP	-6.830	0.184		-4.595	0.541		-4.848	0.487	
6	Thailand	US	ADF	-1.148	0.696		-1.726	0.418		-0.858	0.801	
			PP	-3.436	0.667		-6.305	0.410		-2.194	0.797	
7	Indonesia	Japan	ADF	-1.449	0.559		-1.586	0.491		-1.678	0.443	
			PP	-2.753	0.585		-3.754	0.562		-2.856	0.443	
8	Korea	Japan	ADF	-1.705	0.429		-1.510	0.529		-1.778	0.392	
			PP	-6.298	0.393		-1.498	0.534		-4.898	0.557	
9	Philipines	Japan	ADF	-1.599	0.484		-2.396	0.143		-1.969	0.300	
			PP	-5.153	0.439		-14.781	0.084	*	-3.087	0.285	
10	Singapore	Japan	ADF	-2.497	0.116		-1.493	0.537		-2.455	0.127	
			PP	-7.339	0.110		-4.577	0.450		-9.705	0.101	
11	Thailand	Japan	ADF	-1.505	0.531		-1.796	0.382		-1.188	0.679	
			PP	-3.997	0.492		-5.934	0.354		-2.397	0.675	
12	Indonesia	Thailand	ADF	-1.805	0.378		-2.527	0.109		-1.742	0.410	
			PP	-5.427	0.403		-11.012	0.152		-3.576	0.423	
13	Korea	Thailand	ADF	-3.244	0.018	**	-5.258	0.000	***	-0.313	0.924	
			PP	-13.276	0.039	**	-41.420	0.000	***	-0.547	0.920	
14	Philipines	Thailand	ADF	-3.524	0.007	***	-2.603	0.093	*	-1.831	0.365	
			PP	-22.981	0.010	***	-10.564	0.124		-4.532	0.380	
15	Singapore	Thailand	ADF	-1.373	0.595		-3.432	0.010	***	-0.619	0.867	
			PP	-5.238	0.522		-28.954	0.002	***	-1.773	0.820	
16	Indonesia	Singapore	ADF	-1.327	0.617		-2.936	0.041	**	-0.899	0.788	
			PP	-3.235	0.634		-14.352	0.073	*	-1.272	0.798	
17	Korea	Singapore	ADF	-3.708	0.004	***	-4.289	0.001	***	-2.954	0.039	**
			PP	-19.277	0.004	***	-30.485	0.001	***	-14.622	0.029	**
18	Philipines	Singapore	ADF	-2.070	0.257		-2.429	0.134		-0.834	0.809	
			PP	-8.625	0.328		-9.742	0.147		-1.492	0.794	
19	Indonesia	Philippines	ADF	-1.897	0.334		-2.071	0.257		-1.757	0.402	
			PP	-4.987	0.430		-5.252	0.430		-5.803	0.406	
20	Korea	Philippines	ADF	-2.984	0.036	**	-2.485	0.119		-1.511	0.528	
			PP	-13.076	0.067	*	-8.981	0.227		-2.178	0.527	
21	Indonesia	Korea	ADF	-1.968	0.301		-3.500	0.008	***	-1.405	0.580	
			PP	-4.157	0.417		-1.881	0.341		-2.076	0.584	

Note: (1) RER = E_t + CPI*_t -CPI_t

(2) RER_T = E_t + WPI*_t -WPI_t

(3) RER_N = (CPI*_t -WPI*_t) - (CPI_t - WPI_t)

(4) P-values of ADF and PP are based on MacKinnon (1994).

Table 2-1. Variance ratios and nominal exchange rate variability (Unconditional)

Country-pairs		σ(RER_N)/σ(RER)	σ(RER_N)/σ(RER_T)	σ(Nominal_E)	Prob(Nominal_E)
Japan	US	0.2394	0.2427	0.0333	0.3937
Indonesia	US	0.3748	0.4787	0.0726	0.1552
Korea	US	0.3018	0.3004	0.0312	0.0977
Philipines	US	0.5011	0.4977	0.0304	0.1580
Singapore	US	0.8216	0.6825	0.0159	0.0891
Thailand	US	0.3306	0.3348	0.0277	0.0862
Indonesia	Japan	0.3620	0.4464	0.0753	0.4397
Korea	Japan	0.2272	0.2275	0.0422	0.3937
Philipines	Japan	0.3535	0.3621	0.0445	0.4540
Singapore	Japan	0.5460	0.5154	0.0283	0.3190
Thailand	Japan	0.2498	0.2525	0.0388	0.3793
Indonesia	Thailand	0.4258	0.5334	0.0634	0.1552
Korea	Thailand	0.2851	0.2850	0.0360	0.1207
Philipines	Thailand	0.5016	0.4987	0.0329	0.1638
Singapore	Thailand	0.6364	0.5717	0.0238	0.0948
Indonesia	Singapore	0.4099	0.5157	0.0676	0.1925
Korea	Singapore	0.5067	0.4606	0.0326	0.1322
Philipines	Singapore	0.6130	0.5724	0.0312	0.1868
Indonesia	Philippines	0.4130	0.5001	0.0719	0.2270
Korea	Philippines	0.4113	0.4165	0.0387	0.1983
Indonesia	Korea	0.3446	0.4194	0.0769	0.1753

Table 2-2. Variance ratios and nominal exchange rate variability (Conditional)

Country-pairs		σ(RER_NT)/σ(RER)	σ(RER_NT)/σ(RER_T)	σ(Nominal_E)	Prob(Nominal_E)
Japan	US	0.2357	0.2385	0.0333	0.3937
Indonesia	US	0.3802	0.4843	0.0726	0.1552
Korea	US	0.2977	0.2958	0.0312	0.0977
Philipines	US	0.5055	0.4998	0.0304	0.1580
Singapore	US	0.7924	0.6626	0.0159	0.0891
Thailand	US	0.3352	0.3370	0.0277	0.0862
Indonesia	Japan	0.3717	0.4554	0.0753	0.4397
Korea	Japan	0.2237	0.2234	0.0422	0.3937
Philipines	Japan	0.3520	0.3624	0.0445	0.4540
Singapore	Japan	0.5285	0.5022	0.0283	0.3190
Thailand	Japan	0.2425	0.2450	0.0388	0.3793
Indonesia	Thailand	0.4286	0.5341	0.0634	0.1552
Korea	Thailand	0.3011	0.3063	0.0360	0.1207
Philipines	Thailand	0.5068	0.5066	0.0329	0.1638
Singapore	Thailand	0.6146	0.5579	0.0238	0.0948
Indonesia	Singapore	0.4110	0.5175	0.0676	0.1925
Korea	Singapore	0.5017	0.4569	0.0326	0.1322
Philipines	Singapore	0.6261	0.5814	0.0312	0.1868
Indonesia	Philippines	0.4222	0.5165	0.0719	0.2270
Korea	Philippines	0.4154	0.4213	0.0387	0.1983
Indonesia	Korea	0.3546	0.4384	0.0769	0.1753

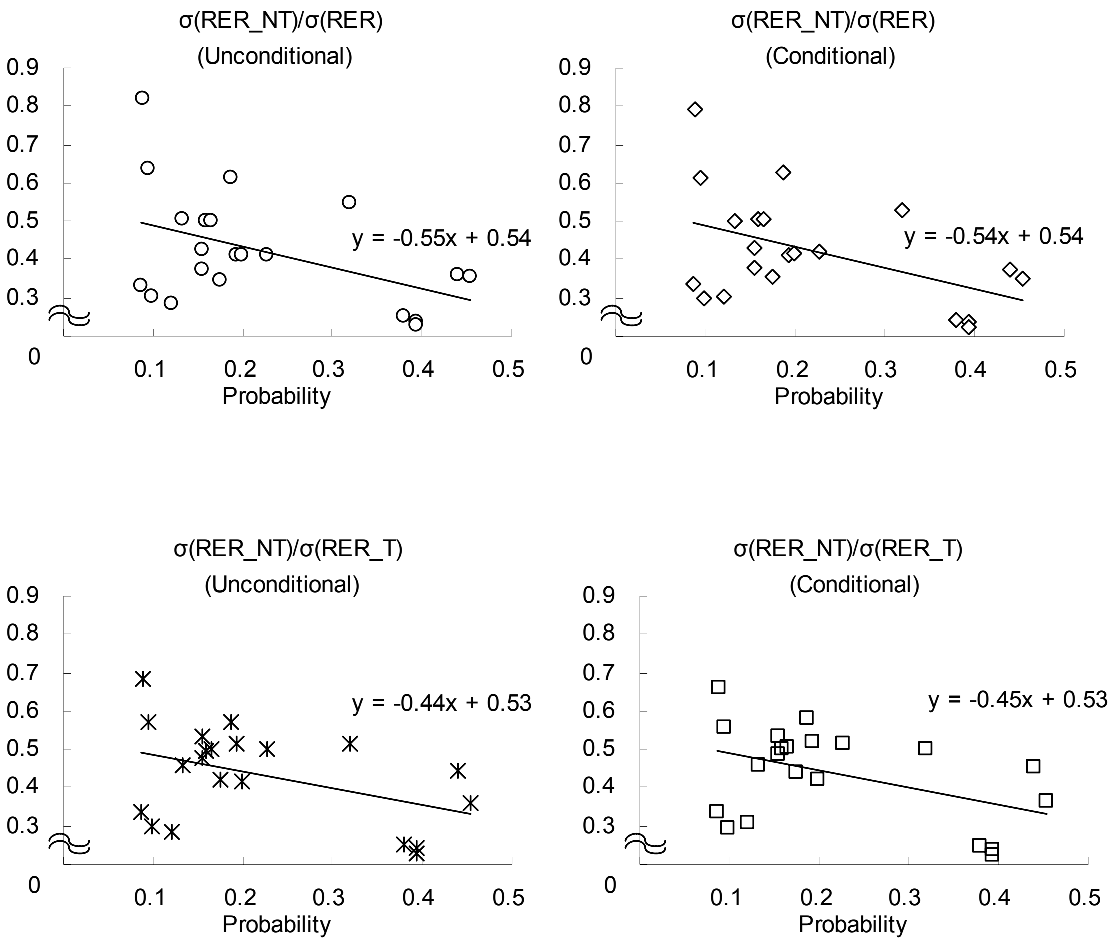
Table3. Summary Statistics

	σ (RER_NT) /σ (RER)		σ (RER_NT) /σ (RER_T)		σ (Nominal_E)	Prob(Nominal_E)
	Unconditional	Conditional	Unconditional	Conditional		
Mean	0.422	0.421	0.434	0.435	0.044	0.220
Std. dev.	0.148	0.142	0.124	0.122	0.019	0.123
Max	0.822	0.792	0.683	0.663	0.077	0.454
Min	0.227	0.224	0.227	0.223	0.016	0.086
Sample size	21	21	21	21	21	21

Table4. Correlation coefficients

			σ (Nominal_E)	Prob (Nominal_E)
σ (RER_NT) /σ (RER)	Unconditional	Coefficients	-0.3862	-0.4546
		P value	0.0837 *	0.0384 **
	Conditional	Coefficients	-0.3578	-0.4691
		P value	0.1113	0.0319 **
σ (RER_NT) /σ (RER_T)	Unconditional	Coefficients	0.0019	-0.441
		P value	0.9936	0.0454 **
	Conditional	Coefficients	0.0525	-0.4503
		P value	0.8212	0.0405 **

Figure 1


σ(RER_NT)/σ(RER)
(Unconditional)
y = -0.55x + 0.54
Probability
σ(RER_NT)/σ(RER)
(Conditional)
y = -0.54x + 0.54
Probability
σ(RER_NT)/σ(RER_T)
(Unconditional)
y = -0.44x + 0.53
Probability
σ(RER_NT)/σ(RER_T)
(Conditional)
y = -0.45x + 0.53
Probability